

What is claimed is:

1. A switch device comprising:

a field effect transistor connected between an input and an output;

5 an overcurrent detecting circuit which detects an overcurrent when a current flowing in said field effect transistor exceeds a predetermined value; and

10 a gate controlling circuit which controls an ON/OFF state of said field effect transistor by controlling a gate voltage of said field effect transistor, said gate controlling circuit changing said gate voltage such that ON resistance of said field effect transistor is gradually decreased after it rises once when said field effect transistor is changed from the OFF state to the ON state.

15 2. The switch device according to claim 1, wherein said gate controlling circuit is supplied with a control signal from the outside indicating the OFF state of said field effect transistor and an overcurrent detecting signal outputted from said overcurrent detecting circuit.

20 3. The switch device according to claim 1, wherein said gate controlling circuit does not hold said switch in the OFF state even though said overcurrent detecting circuit detects the overcurrent due to an inrush current.

25 4. The switch device according to claim 1, wherein said gate controlling circuit sets said field effect transistor to the OFF state in case that said overcurrent detecting circuit detects the overcurrent while the ON resistance of said field effect transistor is gradually

decreased.

5. A switch device comprising:

a field effect transistor connected between an input and an output;

5 a digital/analog converter whose output terminal is connected to a gate terminal of said field effect transistor;

an overcurrent detecting circuit which detects an overcurrent when a current flowing in said field effect transistor exceeds a predetermined value; and

10 a gate controlling circuit which controls an ON/OFF state of said field effect transistor by controlling a gate voltage of said field effect transistor through said digital/analog converter, said gate controlling circuit outputting a digital signal to said digital/analog converter and changing said gate voltage such that ON resistance of said field effect transistor is gradually decreased after it rises once when said field effect transistor is changed from the OFF state to the ON state.

20 6. The switch device according to claim 1, wherein said gate controlling circuit outputs an active slow start signal to said overcurrent detecting circuit while said gate voltage is gradually changed while said field effect transistor is changed from the OFF state to the ON state,

25 said overcurrent detecting circuit notifies a purport that the overcurrent is detected to the outside if the overcurrent is detected when said slow start signal is in

the active state, and notifies a purport that the overcurrent is detected to said gate controlling circuit by setting said overcurrent detecting signal to the active state if the overcurrent is detected when said slow start signal is in the inactive state,

said gate controlling circuit sets said field effect transistor to the OFF state and changes said gate voltage again if the purport that the overcurrent is detected is notified by said overcurrent detecting circuit.

7. The switch device according to claim 6, further comprising a controller which outputs a control signal to set said field effect transistor to the OFF state to said gate controlling circuit if it is receives notification of the purport that the overcurrent is detected by said overcurrent detecting circuit.

8. The switch device according to claim 1, further comprising a load connected to said output and a smoothing condenser connected to said load in parallel.

9. The switch device according to claim 1, wherein said field effect transistor is a P-channel field effect transistor.

10. The switch device according to claim 9, wherein said gate controlling circuit gradually changes the output voltage of said digital/analog converter from a voltage level of said input to 0V when said gate voltage is gradually changed, such that the ON resistance of said switch is gradually decreased after it rises once.

11. The switch device according to claim 1, wherein

said switch device is used as a high side switch.

12. A overcurrent limiting method of a switch device having a field effect transistor connected between an input and an output, a digital/analog converter whose output
5 terminal is connected to a gate terminal of said field effect transistor, an overcurrent detecting circuit which detects an overcurrent when a current flowing in said field effect transistor exceeds a predetermined value, and a gate controlling circuit which controls an ON/OFF state of said
10 field effect transistor by controlling a gate voltage of said field effect transistor through said digital/analog converter, the method comprising the steps of:

outputting a digital signal to said digital/analog converter and outputting an active slow start signal toward
15 said overcurrent detecting circuit such that ON resistance of said field effect transistor is gradually decreased after it rises once, when said field effect transistor is changed from the OFF state to the ON state in the gate controlling circuit;

20 notifying a purport that the overcurrent is detected to the outside by said overcurrent detecting circuit if said overcurrent detecting circuit detects the overcurrent when said slow start signal is in an active state;

notifying a purport that the overcurrent is detected
25 to said gate controlling circuit with outputting said overcurrent detecting signal in an active state by said overcurrent detecting circuit if said overcurrent detecting circuit detects the overcurrent when said slow start signal

is in an inactive state;

outputting by said gate controlling circuit a digital signal to said digital/analog converter such that said field effect transistor is set to the OFF state and then the ON

- 5 resistance of said field effect transistor is gradually decreased again, when said gate controlling circuit receives said overcurrent detecting signal in the active state; and

outputting a control signal for setting said field effect transistor to the OFF state to said gate controlling

- 10 circuit by a controller provided on the outside when the notification of a purport that the overcurrent is detected is received.